KDY 9493
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: William R. Kennedy, et al. Art Unit: 3749
Serial No.: 10/608,901
Filed: June 27, 2003
Confirmation No.: 7782
For: MINE DOOR SYSTEM INCLUDING AN AIR PRESSURE RELIEF DOOR
Examiner: Harold Joyce

February 15, 2005

BRIEF FOR APPELLANT

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BRIEF FOR APPELLANTS

This is an appeal from the final rejection of the claims of the above-identified application made in the Office action mailed December 2, 2004. This Brief for Appellants is being filed simultaneously with a Notice of Appeal.

I. Real Party in Interest

The real parties in interest in the present appeal are William R. Kennedy and John M. Kennedy, both of Taylorville, Illinois, owners of a 100 percent interest in the pending application.

II. Related Appeals and Interferences

Appellants and appellants' legal representative are unaware of any other appeals or interferences which are related to, which would directly affect, which would be directly affected by, or which would have a bearing on the Board's decision in the pending appeal.

III. Status of Claims

Claims 1-35 are pending in the application and stand rejected. The rejection of claims 1-35 is being appealed. The claims on appeal (1-35) are set forth in full in Appendix A to this Brief.

IV. Status of Amendments

No amendments have been filed subsequent to the final rejection.

V. Summary of Claimed Subject Matter

The following summary is provided in accordance with M.P.E.P. §1206 and correlates claim elements to specific embodiments described in the application specification. Consistent with M.P.E.P. §1206, the following summary does not in any manner limit claim interpretation. Rather, the following summary is provided only to facilitate the Board's understanding of the subject matter of this appeal.

In accordance with 37 C.F.R. §41.37(c)(1)(v), Appellants have referred to specific page and line numbers of the specification in the following concise explanation of the subject matter defined in each of the independent claims. Since the pending application does not contain line numbers, Appellants have attached hereto as Appendix B copies of pages 5-15 of the specification with line numbers for the convenience of the Board.

Claim 1 is directed generally to a mine door 21, 170 for installation in a passageway P of a mine comprising a leaf 32, 34, 172 adapted to be mounted in the passageway P for swinging between a closed position and an open position (page 5, lines 5-11 and 27-31, page 15, lines 1-3, Figs. 1, 5, and 10). The leaf 32, 34, 172 has a first face 42 facing in a direction in which it swings open and a second face 44 facing an opposite direction in which it swings closed (page 6, lines 9-12, Fig. 2). The leaf 32, 34 is adapted for installation in the passageway P where the leaf when closed is subject to a differential in air pressure involving higher pressure on one of the faces 42 of the leaf than on the other of the faces 44 of the leaf (page 6, line 33 through page 7, line 8, Fig. 2). The leaf 32, 34, 172 has an opening 62,

174 therein for passage of air therethrough from adjacent the one of the faces 42 of the leaf to adjacent the other of the faces 44 to more nearly equalize the pressure on the faces and thereby reduce the force required to open or close the leaf (page 7, line 30 through page 8, line 2, page 15, lines 1-3, Figs. 1, 2, and 10). A closure 64, 176 is mounted adjacent the opening 62, 174 and is movable between a closed position blocking passage of air through the opening and an open position allowing passage of air (page 8, lines 7-11, page 15, lines 3-5, Figs. 2, 4, and 10). A first actuator 78 is mounted adjacent the closure 64, 176 for moving the closure between the open position and the closed position (page 8, lines 25-29, Figs. 2 and 4A).

Claim 12 is directed generally to a mine stopping system 20 installed in a passageway P of a mine for closing the passageway comprising a wall 46 extending at least partway across the passageway (page 5, lines 5-9, page 6, lines 22-24, Figs. 1 and 2). A door frame 22 is installed in or adjacent the wall 46 to define a doorway 24 to allow passage of machinery (page 5, lines 9-11, Fig. 1). A door leaf 32, 34 is hinged on the door frame 22 for swinging between a closed position in the doorway and an open position (page 5, lines 27-31, Figs. 1 and 5). The leaf 32, 34 has a first face 42 facing in a direction in which it swings open and a second face 44 facing an opposite direction (page 6, line 9-12, Fig. 2). The leaf 32, 34 when closed is subject to a differential in air pressure involving higher pressure on one of the faces 42 of the leaf than on the other of the faces 44 (page 6, line 33 through page 7, line 8, Fig. 2). The door leaf 32, 34 is substantially parallel with the door frame 22 when the leaf is in the closed position (page 5, line 27 through page 6, line 1, Fig. 1). An opening 62 is disposed in at least one of the leaf 32, 34, wall 46 and door frame 22 for passage of air therethrough to more nearly equalize the pressure on the faces 42, 44 of the

leaf and thereby reduce the force required to open or close the leaf (page 7, line 30 through page 8, line 2 and page 14, line 18-26, Figs. 1 and 9). A power-operated closure 64 for the at least one opening 62 is movable between a closed position blocking passage of air and an open position allowing passage of air (page 8, lines 25-29, Figs. 2 and 4A).

Claim 19 is directed generally to a mine door unit 21 for installation in a passageway P of a mine comprising a door frame 22 adapted to be installed in the passageway P to define a doorway 24 sized and shaped to allow passage of machinery (page 5, lines 5-11, page 15, lines Fig. 1). A leaf 32, 34 is hinged on the door frame 22 for moving between a closed position for at least partially closing the doorway and an open position to permit passage of machinery through the doorway (Page 5, line 27-31, Figs 1 and 5). A man doorway 38 in the leaf 32, 34 is sized and shaped to allow passage of personnel (page 6, lines 14-15, Fig. 1). A man door 40 is mounted on the leaf 32, 34 for closing the man doorway 38 (page 6, lines 15-19, Fig. 1). A pressure relief opening 62 is positioned in the leaf 32, 34 and not in the man door 40 (page 8, lines 20-24, Fig. 1). A closure 64 is mounted on the leaf 32, 34 for moving between a closed position for closing the pressure relief opening and an open position for relieving pressure against the leaf to facilitate opening of the leaf (page 8, lines 7-11 and page 13, lines 17-21, Figs. 1 and 5). The closure 64 is not on the man door 40 (page 14, lines 15-18, Fig. 1).

Claim 21 is directed generally to a mine stopping system forming an airlock space in a mine passageway P comprising a plurality of stoppings 20 mounted in the passageway in spaced apart relation to form an airlock with an airlock space therebetween (page 13, line 31 through page 14, line 1, Fig. 8). Each stopping 20 includes a door leaf 32, 34, 172 mounted for

moving between open and closed positions (page 5, lines 27-31, page 15, lines 1-3, Figs. 1, 5, and 10). At least one of the stoppings 20 includes a pressure relief opening 62, 174 therein and a closure 64, 176 mounted adjacent the opening for moving between a closed position for closing the pressure relief opening and an open position for relieving air pressure against the leaf 32, 34, 172 to facilitate opening or closing of the leaf (page 14, lines 3-6, and lines 17-21, page 15, lines 1-5, Figs. 5, 8, and 10). A first actuator 78 is mounted adjacent the closure 64, 176 for moving the closure between the open position and the closed position (page 8, lines 25-29, Fig. 3 and 4A).

Claim 25 is directed generally to a mine door for installation in a passageway of a mine P comprising a power-operated leaf 32, 34, 172 adapted to be mounted in the passageway for swinging between a closed position and an open position (page 5, lines 5-11 and lines 27-31, page 15, lines 1-3, Figs. 1, 5, and 10). The leaf 32, 34, 172 has a first face 42 facing in a direction in which it swings open and a second face 44 facing an opposite direction in which it swings closed (page 6, lines 9-12, Fig. 2). The leaf 32, 34, 172 is adapted for installation in the passageway P where the leaf when closed is subject to a differential in air pressure involving higher pressure on the first face 42 of the leaf than on the second face 44 of the leaf (page 7, lines 6-8, Fig. 2). An opening 62, 174 is formed in the leaf 32, 34, 172 for passage of air therethrough from adjacent one of the faces 42, 44 of the leaf to adjacent the other of the faces 42, 44 to more nearly equalize the pressure on the faces and thereby reduce the force required to open or close the leaf (page 7, lines 30 through page 8, line 2, page 15, lines 1-3, Figs. 2, 5, and 10). A power-operated closure 64, 176 is mounted adjacent the opening 62, 174 and movable between a closed position blocking passage of air through the opening and an open

position allowing passage of air (page 8, lines 7-11, page 15, lines 3-5, Figs. 2, 4, and 10). The closure 64, 176 is mounted such that the closure opens toward the higher pressure (page 8, line 33 through page 9, line 11, Fig. 4). The power-operated closure 64, 176 is movable from the closed position to the open position against pressures up to a first maximum pressure differential (page 13, lines 23-27, Fig. 4). The power-operated leaf 32, 34, 172 is moveable from the closed position to the open position against pressures up to a second maximum pressure differential (page 13, lines 17-23, Fig. 5). The second maximum pressure differential is less than the first maximum pressure differential (page 13, lines 7-17, Figs. 4 and 5).

Claim 31 is directed generally to a mine door 21 for installation in a passageway P of a mine comprising a leaf 32, 34, 172 adapted to be mounted in the passageway for swinging between a closed position and an open position (page 5, lines 5-11 and lines 27-31, page 15, lines 1-3, Figs. 1, 5, and 10). The leaf 32, 34, 172 has a first face 42 facing in a direction in which it swings open and a second face 44 facing an opposite direction in which it swings closed (page 6, lines 9-12, Fig. 2) The leaf 32, 34, 172 is adapted for installation in the passageway P where the leaf when closed is subject to a differential in air pressure involving higher pressure on the first face 42 of the leaf than on the second face 44 of the leaf (page 7, lines 6-8, Fig. 2). A first actuator 56 moves the leaf 32, 34, 172 between the closed position and the open position (page 7, lines 16-20, Figs. 2 and 5). An opening 62, 174 is formed in the leaf 32, 34, 172 for passage of air therethrough from adjacent one of the faces 42, 44 of the leaf to adjacent the other of the faces 42, 44 to more nearly equalize the pressure on the faces and thereby reduce the force required to open or close the leaf (page 7, lines 30 through page 8, line 2, page 15, lines

1-3, Figs. 2, 5, and 10). A closure 64, 176 is movable between a closed position blocking passage of air through the opening 62, 174 and an open position allowing passage of air (page 8, lines 7-11, page 15, lines 3-5, Figs. 2, 4, and 10). A second actuator 78 moves the closure 64, 176 between the open position and the closed position (page 8, lines 25-29, Figs. 1 and 4). The second actuator 78 is mounted to the second face 44 of the leaf 32, 34, 172 such that when the leaf is in the closed position the second actuator is not subjected to the higher pressure (page 8, line 33 through page 9, line 11, Fig. 2).

Claim 33 is directed generally to a mine door 21 for installation in a passageway P of a mine comprising a power-operated leaf 32, 34, 172 adapted to be mounted in the passageway P for swinging between a closed position and an open position (page 5, lines 5-11 and lines 27-31, page 15, lines 1-3, Figs. 1, 5, and 10). The leaf 32, 34, 172 has a first face 42 facing in a direction in which it swings open and a second face 44 facing an opposite direction in which it swings closed (page 6, lines 9-12, Fig. 2). The leaf 32, 34, 172 is adapted for installation in the passageway P where the leaf when closed is subject to a differential in air pressure involving higher pressure on the first face 42 of the leaf than on the second face 44 of the leaf (page 7, lines 6-8, Fig. 2). An opening 64, 174 is formed in the leaf 32, 34, 172 for passage of air therethrough from adjacent one of the faces 42, 44 of the leaf to adjacent the other of the faces 42, 44 to more nearly equalize the pressure on the faces and thereby reduce the force required to open or close the leaf (page 7, lines 30 through page 8, line 2, page 15, lines 1-3, Figs. 2, 5, and 10). A power-operated closure 64, 176 moves between a closed position blocking passage of air through the opening 64, 174 and an open position allowing passage of air (page 8, lines 7-11, page 15, lines 3-5, Figs. 2, 4, and 10). A

switch 184A-D (see U.S. Patent No. 6,425,820, which was incorporated by reference) simultaneously activates the power-operated leaf 32, 34, 172 and the power-operated closure 64, 176 (page 12, lines 7-14, Figs. 2 and 5).

VI. Grounds of Rejection to be Reviewed on Appeal

1. Claims 31 and 34 stand rejected under 35 U.S.C. §112, first paragraph for failing to comply with the written description requirement.

2. Claims 12-18, 25, and 29-33 stand rejected under 35 U.S.C. §102(b) as being anticipated by GB Patent No. 1,485,981 (Gallear).

3. Claims 26-28, 34, and 35 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Gallear.

4. Claims 1-11 and 19-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Gallear in view of U.S. Patent No. 6,425,820 (Kennedy).

VII. Argument

1. Claims 31 and 34 stand rejected under 35 U.S.C. §112, first paragraph for failing to comply with the written description requirement.

A. Claim 31

Claim 31 is directed to a mine door for installation in a passageway of a mine. The mine door comprises:

a leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the

passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on said second face of the leaf,

a first actuator for moving said leaf between said closed position and said open position,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to **open or close** the leaf,

a closure movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a second actuator for moving said closure between the open position and the closed position, the second actuator being mounted to said second face of the leaf such that when the leaf is in the closed position the second actuator is not subjected to the higher pressure.

Claim 31 stands rejected under 35 U.S.C. §112, first paragraph for failing to comply with the written description requirement for using the phrase "or closed" (sic) in line 17 of the claim. Claim 31 recites, in part, "an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf". The written description requirement necessitates that each claim limitation be supported either expressly, implicitly, or inherently in the originally filed disclosure.[1] Page 7 line 30

[1] M.P.E.P. §2163.

through page 8, line 2 of the specification states, "at least one leaf 32, 34 includes a relief opening 62 therein for passage of air through the leaf from adjacent the high pressure side 48 (e.g., adjacent the front face 42) of the leaf to adjacent the low pressure side 50 (e.g., adjacent the rear face 44) to more nearly equalize the pressure on the faces and thereby reduce the force required to open ***or close*** each leaf." (Emphasis added). Thus, the specification expressly supports the improperly rejected text of claim 31.

The phrase "or close" in claim 31 is clearly supported by the express recitation and, therefore, claim 31 complies with the written description requirement of 35 U.S.C. §112. Accordingly, the rejection is in error.

B. Claim 34

Claim 34 depends from claim 33 and recites that the power-operated closure will open prior to [the] power-operated leaf when the air pressure against the first face of the leaf exceeds a predetermined pressure.

The Examiner rejected claim 34 asserting that the claim contains new matter and does not comply with the written description requirement of 35 U.S.C. §112, first paragraph. Appellants respectfully disagree since the originally filed specification clearly conveys to one of ordinary skill in the art that the Appellants had possession of the invention recited in claim 34.

As set forth in more detail in paragraph 0032 at page 12 of the specification, an electrical switch can be used to activate a valve 114 which causes a spool to move and thereby extend the piston rods 57, 80. Piston rods 57 are associated with the door leafs 32, 34, and piston rods 80 are associated with the relief door 64 (Figs. 4A and 5). As illustrated in Fig. 6, parallel

lines supply substantially equal air pressure against the pistons of the cylinders 56, 78. "However, **the piston rods 80 of the relief door cylinders 78 will extend prior to the piston rods 57 of the leaf cylinders 56 when there is significant air pressure against the doors.**" (Emphasis added).

Page 13, paragraph 0034 of the pending application further states that:

> the invention allows much less force or power to be used to open the door leafs. As an example, if each leaf face defines an area of 36 square feet and each leaf cylinder has a piston diameter of about 6 inches, the ratio of the leaf area to the piston area is 183:1 Further, if each relief door face defines an area of 1 foot square, and each relief door cylinder has a piston diameter of about 2 inches, then the ratio of the relief door area to the piston area is 46:1. Thus, in this simplified example in which all other variables are assumed to be equal, each relief door will be able to open against almost 4 times more air pressure than the leafs. **When the relief door 64 opens, air pressure against the leafs 32, 34 is greatly reduced, e.g., by about at least about one-third, more preferably by at least about one-half, and the leaf cylinders should then be able to open the leafs. Accordingly, the leaf cylinders can be sized smaller than would otherwise be necessary to open the leafs. As will be understood by those of skill in the art, in designing the relief door and power mechanism for the relief door, the relief cylinder 78 is sized to open the relief door in the presence of a maximum expected pressure differential, e.g. about twenty (20) IWG.** (Emphasis added).

"Adequate description under the first paragraph of 35 U.S.C. § 112 does not require **literal** support for the claimed invention."[2] (Emphasis in original). "Rather, it is sufficient if the originally-filed disclosure would have conveyed to one having ordinary skill in the art that an [applicant] had

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[2] *Ex parte Parks*, 30 USPQ2d 1234 (B.P.A.I 1994).

possession of the concept of what is claimed."[3] While the specification does not expressly recite "predetermined", the specification clearly shows that Appellants were in possession of the claimed invention. Thus, claim 34 complies with the written description requirement of 35 U.S.C. §112, paragraph 1.

2. Claims 12-18, 25, and 29-33 stand rejected under 35 U.S.C. §102(b) as being anticipated by GB Patent No. 1,485,981 (Gallear).

A. Claims 12, 13, and 15-18

Claim 12 is directed to a mine stopping system installed in a passageway of a mine for closing the passageway. The system comprises:

a wall extending at least partway across the passageway,

a door frame installed in or adjacent the wall to define a doorway to allow passage of machinery,

a door leaf hinged on the door frame for swinging between a closed position in the doorway and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction, the leaf when closed being subject to a differential in air pressure involving higher pressure on one of said faces of the leaf than on the other of said faces, said door leaf being substantially parallel with the door frame when the leaf is in the closed position,

an opening disposed in at least one of said leaf, wall and door frame for passage of air therethrough to more nearly equalize the pressure on said faces of the leaf and thereby reduce the force required to open or close the leaf, and

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[3] *Id.*

a power-operated closure for said at least one opening movable between a closed position blocking passage of air and an open position allowing passage of air.

Claim 12 is unanticipated by Gallear because Gallear fails to show or suggest a mine door including **a door leaf substantially parallel with the door frame when the leaf is in the closed position.** Further, Gallear fails to enable one skilled in the art to make the claimed mine stopping system.

Gallear teaches aligning three sets of mine doors to maintain circulation of ventilation air in the proper direction (i.e., prevent short-circuiting of the mine air system) by allowing only one set of the three sets of doors to be open at any given time. As illustrated in Fig. 1, each set of mine doors includes a pair of mine door leafs 1 pivotally mounted to a bulwark 2 for movement between an open position and a closed position. In the closed position, each of the mine leafs 1 rest against a triangular top plate 5 and a spring loaded tread plate 8 thereby creating a V-formation. A pneumatic piston slidably mounted to the bulwark 2 above the triangular top plate 5 is operable to move both of the leafs 1 simultaneously between the open and closed positions.

A "doorframe" is defined as "the jambs and upper transverse member enclosing the side and top of a doorway and usu. supporting a door."[4] As shown in Fig. 1, the doorframe of Gallear consists the portions of the bulwark 2 adjacent the doorway (i.e., jambs), and the top girder 4 (i.e., the upper transverse). No portion of the triangular top plate 5, which was characterized by the Examiner as being part of the door frame, encloses the doorway. Rather, the top plate is mounted to and

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[4] *Webster's Third New International Dictionary*, 2002.

extends outwardly from a part of the doorframe, the top girder 4. In other words, the triangular top plate 5 does not define the opening in the mine stopping and therefore, is not reasonably considered a part of the claimed door frame.

Since the triangular top plate is not part of the door frame, Gallear fails to teach or suggest a mine door including a door leaf substantially parallel with the door frame when the leaf is in the closed position as recited in claim 12.

Because the structure of claim 12 is not shown or suggested by the prior art, claim 12 is submitted to be unanticipated by and patentable over the prior art of record including Gallear.

Claim 12 is also unanticipated by Gallear since Gallear fails to enable one skilled in the art to make or use a mine door having an opening with a power-operated closure movable between a closed position blocking passage of air through the opening and an open position allowing passage of air through the opening. A reference cited by the Examiner in an anticipation rejection must enable the rejected claimed invention. "The disclosure in an assertedly anticipating reference must provide an enabling disclosure of the desired subject matter; mere naming or description of the subject matter is insufficient, if it cannot be produced without undue experimentation."[5]

Gallear's disclosure of a powered relief door is sketchy at best. As described in column 2, lines 55-63, each of the pressure relief doors 12 can be operated by a pneumatic cylinder controlled and supplied by a pneumatic system 13. While the pneumatic system 13 is shown in Fig. 1 as being mounted along the top of the bulwark 2 in the high pressure side of the mine

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[5] M.P.E.P. §2121.01 citing *Elan Pharm., Inc. v. Mayo Foundation for Medical and Education Research*, 346 F.3d 1051, 1054 (Fed. Cir. 2003).

passage, the pneumatic cylinders, which are indicated to operate the relief doors 12, are not shown. Moreover, the location of the pneumatic cylinders or how the pneumatic cylinders are connected to the relief doors 12 is not described in the specification.

As recognized by the Examiner (see paragraph 2 of the Office action), Gallear fails altogether to describe or show the location of the pneumatic cylinder. Importantly, Gallear also fails to teach or suggest to one of ordinary skill in the art how to connect the pneumatic cylinders to the relief doors such that the pneumatic cylinder can move the relief doors between an open position and a closed position.

Gallear teaches a pneumatic piston 6 slidably mounted to the bulwark 2 above the triangular top plate 5 for simultaneously opening and closing the door leafs 1. However, this same mounting technique cannot be used for the pneumatic cylinders that operate the relief doors 12 since a piston extending between the set of relief doors would block passage through the mine door when the leafs 1 are in the open position. Thus, the only teaching in Gallear on how to mount a pneumatic piston is unsuitable for mounting the pneumatic cylinder to open and close the pneumatic cylinders.

Appellants note that the relief door and the pneumatic cylinder are not claimed in Gallear. As a result, Appellants believe that the teachings in Gallear relating to the pneumatic cylinder and relief doors are not presumed to be valid.

For all the above reasons, Gallear does not enable one skilled in the art on how to make or use a mine door including an opening with a power-operated closure movable between a closed position blocking passage of air through the opening and an open position allowing passage of air through the opening as recited in claim 12.

Claims 13-18, which depend directly or indirectly from claim 12, are unanticipated by Gallear for at least the same reasons as claim 12.

B. Claim 14

Claim 14 depends directly from claim 12 and further recites that the opening is disposed in the wall in which the door frame is installed. As illustrated in Fig. 1, Gallear shows an opening formed in the door leafs, and not the bulwark. Accordingly, Gallear fails to show or suggest an opening disposed in the wall as recited in claim 14. As a result, claim 14 is patentable over Gallear for these additional reasons.

Appellants note that the Examiner in his rejection of claim 14, as set forth in paragraph 4 of the final Office action, does not assert that this feature is shown or suggested by Gallear and therefore, has failed to establish a *prima facie* case in his rejection of claim 14.

C. Claims 25, 29 and 30

Claim 25 is directed to a mine door for installation in a passageway of a mine. The mine door comprises:

a power-operated leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on the second face of the leaf,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to

adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf, and

a power-operated closure mounted adjacent said opening and movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, said closure being mounted such that said closure opens toward the higher pressure,

said power-operated closure being movable from said closed position to said open position against pressures up to a first maximum pressure differential, said power-operated leaf being moveable from said closed position to said open position against pressures up to a second maximum pressure differential, said second maximum pressure differential being less than said first maximum pressure differential.

Claim 25 is unanticipated by Gallear since Gallear does not disclose a mine door having a power-operated closure movable from a closed position to an open position against pressures up to a first maximum pressure differential and a power-operated leaf moveable from a closed position to an open position against pressures up to a second maximum pressure differential, the second maximum pressure differential being less than the first maximum pressure differential.

Gallear is completely silent on the pressures at which the door leaf 1 and the relief door 12 work since their operation is not dependent on pressure. In Gallear, as explained in col. 2, lines 75-80 and lines 97-100, the relief door 12 opens first to allow the pressure on both sides of the mine door to equalize. Only after the pressure has been equalized do the door leafs 1 open.

If there is a significant air pressure against the mine doors claimed in claim 25, the power-operated closure will open prior to the power-operated leafs due to the fact that the ratio of the piston area of the relief door cylinder to the relief door area is much less than the ratio of the piston area of the leaf cylinder to the leaf area. As a result, each relief door will be able to open against more air pressure than the leafs such as a maximum expected pressure differential of about twenty (20) IWG. The power-operated leaf moves once the pressure against the leaf is at or below the capacity of the cylinder used to open and the close the power-operated leaf. The capacity of the leaf cylinder is lower than the capacity of the closure cylinder because of the difference in ratio of the piston area. Thus, the closure will open against a pressure differential greater than the leaf, however the leaf will open prior to the pressure being equalized. This feature reduces the amount of time necessary for the leafs to open, which is not shown by Gallear.

"To be anticipating, a prior art reference must disclose 'each and every limitation of the claimed invention, must be enabling, and must describe the claimed invention sufficiently to have placed it in possession of a person of ordinary skill in the field of the invention.'"[6] Since Gallear fails to disclose, or even suggest, each and every feature of claim 25, claim 25 is patentable over Gallear.

Moreover, to the extent that claim 25 corresponds to claim 12, it is submitted as patentable for the same reasons as claim 12 set forth above. That is, Gallear fails to enable one skilled in the art to make or use a mine door having an opening with a power-operated closure movable between a closed position blocking

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[6] *Helifix, Ltd. v. Blok-Lok, Ltd.*, 208 F.3d 1339, 1346 (Fed. Cir. 2000), citing *In re Paulson*, 30 F.3d 1475, 1478-79 (Fed. Cir. 1994).

passage of air through the opening and an open position allowing passage of air through the opening.

Claims 26-30 depend directly or indirectly from claim 25 and are submitted to be patentable over the references of record for the same reasons as claim 25.

D. Claim 31 and 32

Claim 31 is directed to a mine door for installation in a passageway of a mine. The mine door comprises:

a leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on said second face of the leaf,

a first actuator for moving said leaf between said closed position and said open position,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf,

a closure movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a second actuator for moving said closure between the open position and the closed position, the second actuator being mounted to said second face of the leaf such that when the leaf is in the closed position the second actuator is not subjected to the higher pressure.

Claim 31 is unanticipated by Gallear since Gallear fails to show an actuator mounted to the leaf on the low pressure side of the leaf. As mentioned above, Gallear fails altogether to disclose the location of the pneumatic cylinders used to open and close the relief doors 12. Thus, Gallear fails to disclose an actuator mounted to the door leaf 1.

Moreover, all of the pneumatic equipment disclosed in Gallear is positioned on the high pressure side of the door leaf 1. See col. 2, lines 41-45 and Fig. 1. Accordingly, Gallear fails to show or suggest any actuator mounted on the low pressure side of the leaf 1.

Since Gallear fails to show or suggest each and every feature of claim 31, claim 31 is submitted as being unanticipated by Gallear. Claim 32 depends directly from claim 31 and is submitted to be unanticipated by Gallear for the same reasons as claim 31.

E. Claim 33

Claim 33 is directed to a mine door for installation in a passageway of a mine. The mine door comprises:

a power-operated leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on said second face of the leaf,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the

pressure on said faces and thereby reduce the force required to open or close the leaf,

a power-operated closure movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a switch for simultaneously activating said power-operated leaf and said power-operated closure.

Claim 33 is rejected as anticipated by Gallear despite the fact that Gallear discloses that the pressure on both sides of the door should be equalized before the door opens (col. 2, lines 75-80 and lines 97-100). Gallear's relief door 12 opens first to allow the pressure on both sides of the mine door to equalize. Only after the pressure has been equalized do the door leafs 1 open. Accordingly, Gallear fails to teach a switch for **simultaneously activating** the power-operated leaf and the power-operated closure.

In Appellants' claimed invention, the power-operated leaf and power-operated closure are simultaneously activated by a single valve, which provides substantially equal air pressure to the actuators of the closure and the leaf. If there is a significant air pressure against the doors, the power-operated closure will open prior to the power-operated leafs due to the fact that the ratio of the piston area of the relief door cylinder to the relief door area is much less than the ratio of the piston area of the leaf cylinder to the leaf area. Once the air pressure differential across the door 13 is sufficiently reduced, the leaf opens. But this will occur before pressure is equalized. As a result, the amount of time between when the doors are activated and the doors are opened is minimized. This advantage is not shown or suggested by Gallear.

Since Gallear fails to teach each and every feature of claim 33, claim 33 is submitted as being unanticipated by Gallear.

Claim 34 and 35 depend from claim 33 and are submitted to be unanticipated by Gallear for the same reasons as claim 33.

3. Claims 26-28, 34, and 35 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Gallear.

A. Claims 26-28

Claims 26-28 depend directly or indirectly from claim 25 and are submitted to be patentable over the references of record including Gallear for the same reasons as presented above with respect to claim 25.

B. Claims 34 and 35

Claims 34 and 35 depend directly and indirectly from claim 33, respectively, and are submitted to be patentable over the references of record for the same reasons as presented above with respect to claim 33.

4. Claims 1-11 and 19-24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Gallear in view of U.S. Patent No. 6,425,820 (Kennedy).

A. Claims 1-9

Claim 1 is directed to a mine door for installation in a passageway of a mine. The mine door comprises:

a leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed,

said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on one of said faces of the leaf than on the other of said faces of the leaf,

said leaf having an opening therein for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf,

a closure mounted adjacent said opening and movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a first actuator mounted adjacent said closure for moving said closure between the open position and the closed position.

Claim 1 is patentable because there is no motivation or suggestion to combine Gallear with Kennedy. In order to establish a prima facie case of obviousness based on a combination of prior art references under §103(a), an examiner must set forth some suggestion or motivation to combine the teachings of the prior art references, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art at the time of the invention.[7] No such suggestion or motivation exists here.

Gallear, as described above in more detail, teaches mine doors having a pair of mine door leafs 1 pivotally mounted to a bulwark 2 for movement between an open position and a closed position by extension and retraction of pneumatic piston 6. In the closed position, each of the leafs 1 rest against a triangular top plate 5 and a spring loaded tread plate 8 thereby

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[7] M.P.E.P. §706.02(j).

creating a V-formation. Each of the door leafs has a pressure relief door 12 operable by a pneumatic cylinder (not shown) for opening the door before the leafs opening to equalize the pressure on both sides of the bulwark 2.

Kennedy teaches, as seen in Figs. 1, 3, and 5, extensible piston cylinders 70-73 mounted at one end to a respective leaf 60A-D adjacent an upper edge of the leaf adjacent the vertical axis of the door and at the other end to the lintels 36 of the respective doors. The cylinders 70-73 can be extended to move the respective leaf 60A-D to an open position and retracted to move the respective leaf to a closed position.

There is no motivation or suggestion in either Gallear or Kennedy to place the pneumatic cylinders for operating the relief doors taught by Gallear adjacent the door as taught by Kennedy. (Appellants note that the Examiner has relied on Kennedy solely for its teaching of placing a piston cylinder adjacent a door.) For the pneumatic cylinders of Gallear to be placed adjacent the relief door, the cylinders would have to be mounted on the moveable door leafs 1. Neither Gallear nor Kennedy teach mounting a pneumatic cylinder on a moving door leaf. In Gallear, the piston 6 is mounted to the top girder 4 (Fig. 1) and in Kennedy, the cylinders 70-73 are mounted to the lintels 36.

If there is no suggestion or motivation for the combination of references used to reject a claim, a reviewing court will infer that the references were selected with the assistance of hindsight.[8] The use of hindsight in selecting references for combination in a §103(a) rejection is forbidden.[9] Without the requirement to show some suggestion or motivation to combine

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[8] *In re Rouffet*, 149 F.3d 1350, 1358, 47 U.S.P.Q.2d 1453 (Fed. Cir. 1998).

[9] *Id.*

references, an examiner could use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat patentability of the invention.[10]

Moreover, Gallear teaches that all of the pneumatic equipment necessary for operating a pneumatic cylinder is positioned on the high pressure side of the door and that a single pneumatic cylinder is used to open both door leafs 1. As a result, Gallear teaches that the cylinder for opening and closing the relief door 12 would have to be mounted on the high pressure side and expand between the two relief doors. Mounting a cylinder in this manner to open and close the relief doors 12 would prevent the door leafs 1 from opening or, at a minimum, block passage through the doorway.

Furthermore, Gallear and Kennedy both teach away from the invention, which is a significant factor to be considered in determining obviousness.[11] Gallear, as mentioned above, discloses a single way to mount a pneumatic cylinder for opening and closing the door leafs 1. Gallear's pneumatic cylinder is mounted to a fixed structure on the high pressure side of the mine stopping and can be extended to open the leafs and retracted to close the leafs. This mounting technique will not work for mounting a cylinder to open and close the relief doors 12 since doing so would require the cylinder to be mounted to a moving structure, the door leaf. In addition, if the cylinder was mounted to the two door leafs, it would extend across the opening when the door leafs were open and block passage through the doorway or would prevent the door leafs from opening altogether. Accordingly, the pneumatic cylinder mounting technique shown by

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[10] *Rouffet* at 1357.

[11] M.P.E.P. §2145 (X)(D).

Gallear teaches away from the claimed first actuator mounted adjacent the closure.

Kennedy discloses that the pneumatic cylinders 70-73 are mounted using a bracket 82 to the fixed lintel 36 such that the cylinders extend outwardly and generally perpendicular to the mine stopping (Figs. 1 and 5). Thus, Kennedy discloses that the cylinders should be mounted to a fixed structure (i.e., lintel 36) and not a moving structure such as a door leaf. Moreover, the Kennedy mounting technique results in the cylinder 70-73 and the bracket 82 extending outwardly from the mine stopping, which is not suitable for mounting a cylinder to a door leaf for opening and closing a relief door. If this technique was used to mount a cylinder to a door leaf, the outwardly extending cylinder and bracket would be low enough on the leaf to present a potential danger to individuals and equipment attempting to pass through the doorway. For example, with the leafs in the open position, the cylinder and bracket would extend from the leaf into the pathway used by personnel and equipment to pass through the doorway. In the closed position, the extending bracket and cylinder would pose a danger to personnel and equipment near the door leaf. In Kennedy, both the bracket and the cylinder are mounted above the pathway used by mining personnel and equipment which would not be the case if the bracket and cylinder were mounted to the door leaf. Accordingly, the Kennedy cylinder mounting technique is not only unsuitable for mounting a pneumatic cylinder to a door leaf but teaches away from doing so since doing so would create a potential hazard.

Thus, there is no motivation or suggestion to combine Gallear with Kennedy to develop a mine door including an actuator **mounted adjacent a closure** for moving the closure between an open position and a closed position, as recited in claim 1.

Claim 1 is also patentable over Gallear in view of Kennedy since the cited references do not teach one skilled in the art of mine doors how to make or use a mine door recited in claim 1. "In order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and use the apparatus or method."[12]

Gallear, as mentioned in more detail above with respect to claim 12, does not enable one skilled in the art to make or use a mine door including a first actuator mounted adjacent a closure for an opening in a mine door leaf for moving the closure between an open position and a closed position as recited in claim 1.

Kennedy discloses, as illustrated in Figs. 1 and 2, a mine door system 10 for erecting in a mine passageway 14 having a high pressure side 16 and a low pressure side 18. The mine door system 10 includes a pair of doors 20, 22 spaced apart along the mine passageway 14. Each door 20, 22 includes two leafs 60 (designated 60A, B for door 20 and 60C, D for door 22 for clarity) hingedly mounted for selective movement by a hydraulic system 89 between open and closed positions. The movement of each door 20, 22 is managed by a control system. A supplemental man door 64 can be hingedly mounted on one or more of the leafs 60 to provide for ingress to and egress from the air lock space 25 by personnel without having to open any of the leafs 60A-D. The door 64 is releasably retained closed by a latch 66. The man door is not connected to control system.

Kennedy teaches a man door in the door leaf for allowing personnel to pass through the mine door system without opening the mine door leafs and thus, <u>without activating the control system</u>. Accordingly, Kennedy also fails to enable one skilled in

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[12] *Beckman Instruments, Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1551 (Fed. Cir. 1989) citing *In re Payne* 606 F.2d 303, 314 (C.C.P.A. 1979).

the art of mine doors to make or use a mine door as recited in claim 1. Particularly, Kennedy fails to enable a mine door including a first actuator mounted adjacent a closure for an opening in a mine door leaf for moving the closure between an open position and a closed position.

Since Gallear and Kennedy each fail individually to enable one skilled in the art to make the invention recited in claim 1, a combination of Gallear and Kennedy likewise fails to enable one skilled in the art to make the claimed invention. Accordingly, claim 1 is submitted to be patentable over the prior art of record including Gallear and Kennedy.

Claims 2-11, which depend directly or indirectly from claim 1, are patentable for at least the same reasons as claim 1.

B. Claim 10

Claim 10 indirectly depends from claim 1 and further recites that the door frame is adapted for mounting a second leaf adjacent the first-mentioned leaf, respective faces of the first and second leafs being substantially coplanar when the leafs are in the closed position.

As described in more detail above with respect to claim 12, the mine door leafs 1 taught by Gallear rest against a triangular top plate 5 and a spring loaded tread plate 8 in the closed position. As a result, the mine door leafs 1 create a V-formation when closed and as a result, the faces of the mine door leafs at disposed at an angle with respect to the other. Accordingly, Gallear fails to teach a mine door having faces of the first and second leafs substantially coplanar when the leafs are in the closed position as recited in claim 10.

The Examiner has taken the position, as set forth in paragraph 2 of the final Office action, that "the first and second leaf to be coplanar would have been obvious in view of the

negative teachings at page 2, lines 41-45 of the United Kingdom patent if one did not want to take the benefit of a door which would require less force to initially open it against pressure." Applicant's respectfully disagree. In Gallear, the mine door leafs 1 being positioned in a V-formation is essential for the operation of the pneumatic piston 6, which is used to open and close the door leafs. If the door leafs 1 of Gallear were placed side-by-side such that the faces of the door leafs were coplanar, as recited in claim 10, the pneumatic piston 6 would be unable to swing the door leafs between the open and closed positions. In other words, Gallear does not enable a coplanar arrangement.

As a result, claim 10 is submitted to be further patentable over Gallear in view of Kennedy for these additional reasons.

C. Claim 11

Claim 11, which depends from claim 1, further recites that the leaf includes a man door opening and a man door mounted on the leaf for moving between a closed position for closing the man door opening and an open position for allowing personnel to pass through the man door opening, the closure being spaced from the man door.

To the extent claim 11 corresponds to claim 19, it is submitted as patentable for the same reasons as claim 19 set forth below.

D. Claims 19 and 20

Claim 19 is directed to a mine door unit for installation in a passageway of a mine. The mine door unit comprises:

a door frame adapted to be installed in the passageway to define a doorway sized and shaped to allow passage of machinery,

a leaf hinged on the door frame for moving between a closed position for at least partially closing the doorway and an open position to permit passage of machinery through the doorway,

a man doorway in the leaf sized and shaped to allow passage of personnel,

a man door mounted on the leaf for closing the man doorway,

a pressure relief opening in the leaf and not in the man door, and

a closure mounted on the leaf for moving between a closed position for closing the pressure relief opening and an open position for relieving pressure against the leaf to facilitate opening of the leaf, the closure not being on the man door.

Gallear teaches aligning three sets of mine doors to maintain circulation of ventilation air in the proper direction (i.e., prevent short-circuiting of the mine air system) by allowing only one set of the three sets of doors to be open at any given time. A bulwark 2, in combination with a pair of mine leafs 1 positioned in a V-formation, forms a barrier that extends across a passageway in the mine thereby creating a pressure differential between opposite sides of the bulwark. Thus, one side of the bulwark 2 is a high pressure side and the other opposite side is a lower pressure side. Each of the door leafs has a pressure relief door 12 that open prior to the leafs opening to equalize the pressure on both sides of the bulwark 2. Pressure equalization between sets of doors is taught in Gallear to prevent trapping or injuring persons passing through the door system in the event someone else would force the leafs of an adjacent set of door open. Without equalizing the pressure between sets of doors, opening the door leafs 1 mounted on the high pressure side of the airlock system may cause any open door leafs mounted on the adjacent low pressure side to slam shut

thereby potentially injuring or trapping anyone in the process of passing through the door.

Kennedy discloses, as illustrated in Figs. 1 and 2, a mine door system 10 for erecting in a mine passageway 14 having a high pressure side 16 and a low pressure side 18. The mine door system 10 includes a pair of doors 20, 22 spaced apart along the mine passageway 14. Each door 20, 22 includes two leafs 60 (designated 60A, B for door 20 and 60C, D for door 22 for clarity) hingedly mounted for selective movement by a hydraulic system 89 between open and closed positions. The movement of each door 20, 22 is managed by a control system. A supplemental man door 64 can be hingedly mounted on one or more of the leafs 60 to provide for ingress to and egress from the air lock space 25 by personnel without having to open any of the leafs 60A-D. The door 64 is releasably retained closed by a latch 66. The man door is not connected to control system.

In this case, there is no suggestion or motivation to combine Gallear and Kennedy. Gallear relates to a mine door control system operable to equalize the pressure between sets of doors to thereby prevent potential injures caused by doors on the high pressure side being opened while someone is passing through the doors on the adjacent low pressure side and thereby causing the doors mounted on the low pressure side to slam shut. Kennedy teaches man doors for allowing personnel to pass through the mine door system without opening the mine door leafs and thus, without activating the control system. There is no motivation or suggestion to add the man doors taught by Kennedy to the mine door system of Gallear since doing so would circumvent the control system teachings of Gallear, i.e., that the doors in the mine door system should be controlled so that the doors of adjacent sets of doors cannot be opened simultaneously. Gallear therefore does not contemplate the addition of a manually

operable man door. Indeed, Gallear teaches away from mounting a door, such as the Kennedy man door, that is independent of the control system. A prior art reference must be considered in its entirety, i.e. as a whole, including portions that would lead away from the claimed invention.[13] The Examiner did not consider the references as a whole.

Accordingly, claim 19 is patentable over Gallear and Kennedy since there is no motivation or suggestion to combine these references.

Claim 20 depends from claim 19 and is submitted as patentable over the references of record, including Gallear in combination with Kennedy, for at least the same reasons as claim 19.

E. Claims 21-24

Claim 21 is directed to a mine stopping system forming an airlock space in a mine passageway. The mine stopping system comprises:

a plurality of stoppings mounted in the passageway in spaced apart relation, said stoppings forming an airlock with an airlock space therebetween,

each stopping including a door leaf mounted for moving between open and closed positions,

at least one of said stoppings including a pressure relief opening therein and a closure mounted adjacent the opening for moving between a closed position for closing the pressure relief opening and an open position for relieving air pressure against the leaf to facilitate opening or closing of the leaf, and

a first actuator mounted adjacent said closure for moving said closure between the open position and the closed position.

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[13] M.P.E.P. §2141.02

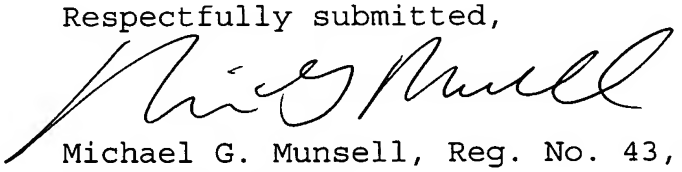
To the extent amended claim 21 corresponds to claim 1, it is submitted as patentable for the same reasons as claim 1. Claims 22-24 depend directly or indirectly from claim 21 and are submitted to be patentable over the references of record for the same reasons as claim 21.

VIII. Conclusion

The rejections of the claims on appeal are in error for the reasons set forth above. Therefore, Appellants request that the Examiner's rejections of claims 1-35 be reversed.

* Enclosed is a check in the amount of $250 for the appeal brief fee under 37 C.F.R. §41.20(b)(2). Any additional fee may be charged to Deposit Account No. 19-1345.

Respectfully submitted,



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APPENDIX A
PENDING CLAIMS ON APPEAL

1. (Previously presented) A mine door for installation in a passageway of a mine comprising:

a leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed,

said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on one of said faces of the leaf than on the other of said faces of the leaf,

said leaf having an opening therein for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf,

a closure mounted adjacent said opening and movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a first actuator mounted adjacent said closure for moving said closure between the open position and the closed position.

2. (Original) A mine door as set forth in claim 1 installed in the mine such that the higher pressure is on the first face of the leaf so that the leaf opens toward the higher pressure.

3. (Original) A mine door as set forth in claim 2 wherein the closure is hinged on the leaf so that the closure opens toward the higher pressure.

4. (Original) A mine door as set forth in claim 1 wherein the closure is hinged on the leaf so that the closure opens toward the higher pressure.

5. (Previously presented) A mine door as set forth in claim 1 wherein the first actuator for moving the closure is operated by a power mechanism adapted for opening the leaf after opening the closure.

6. (Previously presented) A mine door as set forth in claim 5 wherein the power mechanism includes a single source of pressurized fluid, the first actuator operably connected to the closure and to the single source, and a second actuator operably connected to the leaf and to the single source, the power mechanism being constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.

7. (Original) A mine door as set forth in claim 6 wherein the power mechanism further includes parallel fluid supply lines to the first and second actuators adapted for opening the closure and the leaf in sequence.

8. (Original) A mine door as set forth in claim 7 wherein the pressurized fluid is air.

9. (Original) A mine door as set forth in claim 1 in combination with a door frame adapted for installation in the passageway and adapted for mounting the leaf.

10. (Original) A mine door as set forth in claim 9 wherein the door frame is adapted for mounting a second leaf adjacent the first-mentioned leaf, respective faces of the first and second leafs being substantially coplanar when the leafs are in the closed position.

11. (Original) A mine door as set forth in claim 1 wherein the leaf includes a man door opening and a man door mounted on the leaf for moving between a closed position for closing the man door opening and an open position for allowing personnel to pass

through the man door opening, the closure being spaced from the man door.

12. (Previously presented) A mine stopping system installed in a passageway of a mine for closing the passageway, the system comprising:

a wall extending at least partway across the passageway,

a door frame installed in or adjacent the wall to define a doorway to allow passage of machinery,

a door leaf hinged on the door frame for swinging between a closed position in the doorway and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction, the leaf when closed being subject to a differential in air pressure involving higher pressure on one of said faces of the leaf than on the other of said faces, said door leaf being substantially parallel with the door frame when the leaf is in the closed position,

an opening disposed in at least one of said leaf, wall and door frame for passage of air therethrough to more nearly equalize the pressure on said faces of the leaf and thereby reduce the force required to open or close the leaf, and

a power-operated closure for said at least one opening movable between a closed position blocking passage of air and an open position allowing passage of air.

13. (Original) A mine stopping system as set forth in claim 12 wherein the opening is disposed in said leaf.

14. (Original) A mine stopping system as set forth in claim 12 wherein the opening is disposed in said wall.

15. (Original) A mine stopping system as set forth in claim 12 wherein the leaf is power-operated, the stopping system further comprising a power mechanism including a single source of pressurized fluid for operating said closure and said leaf, said

power mechanism adapted for opening the leaf only after the closure is opened.

16. (Original) A mine stopping system as set forth in claim 15 wherein the power mechanism further includes a first actuator operably connected to the closure and to the single source, and a second actuator operably connected to the leaf and to the single source, the power mechanism constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.

17. (Original) A mine stopping system as set forth in claim 16 wherein the leaf is installed such that the higher pressure is on the first face of the leaf so that the leaf opens toward the higher pressure, and wherein the closure is mounted so that the closure opens toward the higher pressure.

18. (Original) A mine stopping system as set forth in claim 17 wherein the power mechanism further includes parallel fluid supply lines to the first and second actuators and a valve movable to an open position for allowing fluid to flow to the first and second actuators in parallel and to cause the closure and the leaf to open in sequence.

19. (Original) A mine door unit for installation in a passageway of a mine comprising:

a door frame adapted to be installed in the passageway to define a doorway sized and shaped to allow passage of machinery,

a leaf hinged on the door frame for moving between a closed position for at least partially closing the doorway and an open position to permit passage of machinery through the doorway,

a man doorway in the leaf sized and shaped to allow passage of personnel,

a man door mounted on the leaf for closing the man doorway,

a pressure relief opening in the leaf and not in the man door, and

a closure mounted on the leaf for moving between a closed position for closing the pressure relief opening and an open position for relieving pressure against the leaf to facilitate opening of the leaf, the closure not being on the man door.

20. (Original) A mine door unit as set forth in claim 19 wherein the closure is power-operated.

21. (Previously presented) A mine stopping system forming an airlock space in a mine passageway comprising:

a plurality of stoppings mounted in the passageway in spaced apart relation, said stoppings forming an airlock with an airlock space therebetween,

each stopping including a door leaf mounted for moving between open and closed positions,

at least one of said stoppings including a pressure relief opening therein and a closure mounted adjacent the opening for moving between a closed position for closing the pressure relief opening and an open position for relieving air pressure against the leaf to facilitate opening or closing of the leaf, and

a first actuator mounted adjacent said closure for moving said closure between the open position and the closed position.

22. (Original) A mine stopping system as set forth in claim 21 wherein the opening is in the leaf of said at least one stopping and the closure is mounted on the leaf.

23. (Previously presented) A mine stopping system as set forth in claim 22 wherein the first actuator for moving the closure is operated by a power mechanism adapted for opening the leaf after opening the closure.

24. (Previously presented) A mine stopping system as set forth in claim 23 wherein the power mechanism includes a single source of pressurized fluid, the first actuator operably connected to the closure and to the single source, and a second

actuator operably connected to the leaf and to the single source, the power mechanism constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.

25. (Previously presented) A mine door for installation in a passageway of a mine comprising:

a power-operated leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on the second face of the leaf,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf, and

a power-operated closure mounted adjacent said opening and movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, said closure being mounted such that said closure opens toward the higher pressure,

said power-operated closure being movable from said closed position to said open position against pressures up to a first maximum pressure differential, said power-operated leaf being moveable from said closed position to said open position against pressures up to a second maximum pressure differential, said second maximum pressure differential being less than said first maximum pressure differential.

26. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 25 wherein said

first maximum pressure is between about 2 and about 4 times greater than the second maximum pressure.

27. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 25 wherein said first maximum pressure is about 20 inches water gauge.

28. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 26 wherein said second maximum pressure is between about 5 inches water gauge and about 10 inches water gauge.

29. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 25 wherein the power-operated closure and the power-operated leaf are operated by a power mechanism adapted for opening the leaf after opening the closure.

30. (Previously presented) A mine door as set forth in claim 29 wherein the power mechanism includes a single source of pressurized fluid, a first actuator operably connected to the closure and to the single source, and a second actuator operably connected to the leaf and to the single source, the power mechanism being constructed to apply driving force to the closure and to the leaf for opening and closing the closure and the leaf.

31. (Previously presented) A mine door for installation in a passageway of a mine comprising:

a leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on said second face of the leaf,

a first actuator for moving said leaf between said closed position and said open position,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf,

a closure movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a second actuator for moving said closure between the open position and the closed position, the second actuator being mounted to said second face of the leaf such that when the leaf is in the closed position the second actuator is not subjected to the higher pressure.

32. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 31 wherein said first actuator is located in said passageway such that when the leaf is in the closed position the first actuator is opposed to said second face of the leaf and is not subjected to the higher pressure.

33. (Previously presented) A mine door for installation in a passageway of a mine comprising:

a power-operated leaf adapted to be mounted in the passageway for swinging between a closed position and an open position, the leaf having a first face facing in a direction in which it swings open and a second face facing an opposite direction in which it swings closed, said leaf being adapted for installation in the passageway where the leaf when closed is subject to a differential in air pressure involving higher pressure on said first face of the leaf than on said second face of the leaf,

an opening formed in the leaf for passage of air therethrough from adjacent said one of said faces of the leaf to

adjacent the other of said faces to more nearly equalize the pressure on said faces and thereby reduce the force required to open or close the leaf,

a power-operated closure movable between a closed position blocking passage of air through said opening and an open position allowing passage of air, and

a switch for simultaneously activating said power-operated leaf and said power-operated closure.

34. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 33 wherein the power-operated closure will open prior to power-operated leaf when the air pressure against the first face of the leaf exceeds a predetermined pressure.

35. (Previously presented) A mine door for installation in a passageway of a mine as set forth in claim 34 wherein said predetermined pressure is between about 5 inches water gauge and about 10 inches water gauge.

[0021] Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Detailed Description of the Preferred Embodiment

[0022] Referring to FIG. 1, there is generally indicated at 20 one embodiment of a mine stopping of this invention installed in a mine passageway P having a floor F, ceiling C and left and right ribs indicated at L, R, respectively. A door unit of the stopping is generally designated 21 and comprises a door frame, generally designated 22, which defines a doorway 24 to allow passage of machinery. The door frame 22 comprises a pair of vertical metal columns 26 at opposite sides of the doorway and a lintel 28 supported by the columns and extending across the top of the doorway. As described more completely in U.S. Pat. No. 5,240,349, incorporated herein by reference, each column 26 has a foot (lower) end 29 engageable with the floor F of the passageway, a head (upper) end 30 engageable with the ceiling C, and is made up of a plurality of sections (e.g., tubular sections) which may be locked in telescoped relation to one another. The lintel 28 is connected at its opposite ends to the columns 26. A jack (not shown) may be used to install the columns, such as described in U.S. Pat. Nos. Re. 5,240,349 and 5,222,838, which are incorporated herein by reference. Other types of door frames or other structures for supporting the door may be used within the scope of this invention.

[0023] In a preferred embodiment, the door unit 21 includes a pair of generally rectangular door leafs 32, 34 hinged on the columns 26 of the door frame 22 at opposite sides of the doorway 24 for swinging between an open position (Fig. 5) to permit passage through the doorway and a closed position (Figs. 1-2) in which the door leafs are generally coplanar to

close the doorway. As viewed in Fig. 1, the left-hand leaf is generally designated 32 and the right-hand leaf is generally designated 34. The door leafs are mounted on the columns 26 at opposite sides of the doorway by hinges 36 (Fig. 2), preferably as described in Pat. No. Re. 36,853, incorporated herein by reference. Each leaf may be suitably constructed as described in Pat. No. Re. 36,853 and in Pat. App. No. 10/003,353 filed November 1, 2001, also incorporated herein by reference, though other types of doors are contemplated. Each leaf has a first front face 42 facing away from the door frame and in a direction in which it swings open, and a second rear face 44 (Fig. 5) facing toward the door frame. The left-hand leaf 32 includes an astragal 45 for sealing the gap between the leafs. In this embodiment, leaf 32 includes a man doorway or opening sized and shaped to allow passage of personnel. A man door is mounted on the leaf 26, as by hinges (not shown), for moving between a closed position for closing the man door opening and an open position for allowing personnel to pass through the man door opening. Note the man door may also be mounted to slide between its open and closed positions, e.g., the man door may be mounted in tracks (not shown).

[0024] As illustrated in FIG. 1, the stopping system includes a wall 46 extending at least partway across the passageway P. In this embodiment, the wall includes a top panel structure TP of the type described in Pat. No. Re. 36,853, incorporated herein by reference, to close the space between the lintel 28 of the frame 22 and the ceiling C of the mine passageway. The gaps between the columns 26 of the door frame 22 and the ribs L, R of the passageway may be closed by vertical panels VP of the wall 46, also described in the aforementioned patent. It is contemplated that the wall be made of masonry or other materials.

[0025] The stopping system 20 is used to substantially seal against air flow through the passageway P,

thereby creating an air pressure differential across the stopping system with a normally high pressure side 48 and a normally low pressure side 50 (Fig. 2). This pressure differential applies force to the stopping system 20 in a direction from the high pressure side 48 toward the low pressure side 50. As properly mounted in the passageway, the front face 42 of each leaf faces the high pressure side 48, and the rear face 44 faces the low pressure side 50. It is to be understood that the high pressure side and the low pressure side may switch under some circumstances but are normally in one orientation. Moreover, it is contemplated within the scope of this invention that the doors be intentionally or unintentionally mounted "backwards," i.e., such that the front face faces the low pressure side, and the rear face faces the high pressure side.

[0026] A power mechanism is associated with each leaf 32, 34 to effect its movement between open and closed positions. This mechanism includes power actuators in the form of extensible double-acting piston cylinders 56 each of which is pivotally mounted to a support 58 extending from the lintel. The cylinders 56 are similar to those described in detail in U.S. Pat. No. 6,425,820 (which is incorporated herein by reference), except that the cylinders of this embodiment are pneumatically powered (hereinafter, pneumatic) rather than hydraulically powered. Each cylinder 56 has a closed end 56a, a rod end 56b and a piston rod 57 that is extendable and retractable with pressurized fluid. A suitable piston cylinder is Model No. JK19226 available from Jack Kennedy Metal Products & Buildings, Inc., Taylorville, IL 62568.

[0027] Referring to Figs. 1 and 2, at least one leaf 32, 34 includes a relief opening 62 therein for passage of air through the leaf from adjacent the high pressure side 48 (e.g., adjacent the front face 42) of the leaf to adjacent the low pressure side 50 (e.g., adjacent the rear face 44) to more

nearly equalize the pressure on the faces and thereby reduce the force required to open or close each leaf. In this embodiment, there is a relief opening 62 in each leaf 32, 34, though it is contemplated to include just one relief door in the door unit. The relief opening 62 is generally rectangular, e.g., square as shown, though other shapes are contemplated. A closure or relief door, generally designated 64, is mounted, as by hinges 66, on each leaf 32, 34 and is movable between a closed position blocking passage of air through the relief opening and an open position allowing passage of air therethrough. Each relief door 64 is sized and shaped to close the relief opening 62 and comprises, in one embodiment, a single panel 68 of sheet metal (e.g., square as shown) although other constructions are contemplated. Edges 70 of the door may be reinforced, as by being bent to form a channel as shown. A seal 72 (e.g., a D-shaped rubber seal as shown in Fig. 4A) is attached to the edges 70 and extends around the periphery of the relief door 64 for engaging the respective leaf 32, 34 to form a substantially air-tight seal therebetween when the relief door is in the closed position. Preferably, the relief opening 62 is spaced from the man door 40, i.e., is not in the man door, so that the relief door power mechanism (as further described below) does not obstruct the man door opening 38 when the man door is in its open position.

[0028] Referring to Figs. 3 and 4A, each relief door 64 is operated by a power mechanism comprising, in one embodiment, power actuators, such as pneumatic, extensible double-acting piston cylinders (hereinafter relief cylinders 78). A suitable piston cylinder is Model No. JK25220 available from Jack Kennedy Metal Products & Buildings, Inc., Taylorville, IL 62568. It is contemplated that hydraulic cylinders, as well as single-acting cylinders be used within the scope of this invention. Briefly, in a preferred embodiment each relief cylinder 78 includes a closed end 78a,

a rod end 78b, and a piston rod 80 that is extendable and retractable with pressurized fluid (e.g., air in a pneumatic system or liquid hydraulic fluid in a hydraulic system). Each relief cylinder 78 is pivotally connected to a support 83 on the rear face of each leaf, as by a clevis-type connection 84. A rigid link 86 has a first end 88 pivotally connected to the piston rod and a second end 90 fixed, as by welding, to the relief door 64. The link 86 is curved to transfer the linear motion of the piston rod 80 through the angle between the cylinder 78 and the relief door 64. (As shown, the angle is about 90°, though the angle will vary.) Because the link is curved, the relief cylinder 78 may be mounted close to and generally parallel to the leaf 32, 34 so that the relief cylinder does not protrude substantially from the leaf and obstruct the doorway. As will be understood, the connection between the piston rod 80 and relief door 64 may be made in other ways within the scope of this invention. In addition, the piston rod 80 may connect directly to the relief door 64 (i.e., no connecting link therebetween) where, for example, the relief door is mounted for linear motion. Other types of actuators, e.g., linear actuators or screw cylinders may be used within the scope of this invention. Further, the relief door 64 of this embodiment is power-operated, but it may, in some circumstances, be manually-operated within the scope of this invention.

[0029] Referring to Fig. 6, the power mechanism includes an electrically controlled pneumatic circuit, generally designated 100, for powering and controlling the cylinders. Generally, the circuit includes, in one embodiment, a compressed air source 102 (generally, pressurized fluid), a filter 104, a check valve 105, a pressurized oil reservoir 106 connected to a checking system 107, a pressure relief valve 108, an air pressure regulator 110, an air line oiler 112 and a valve generally designated 114. In one embodiment, a housing

116 (shown in Fig. 2 and omitted from Figs. 4, 5) is disposed adjacent the door unit 21 and contains all the above-listed components of the circuit 100 except for the air source 102 and portions of the checking system. The circuit 100 may include only a single air source 102, and more preferably, the air source is the mine's pre-existing compressed air source (typically standard equipment of the mine) so that no new source of fluid power needs to be installed to power the system of this invention. The air source may provide air at a variety of pressures, typically about 60 to about 120 psi, but can vary to as low as about 40 psi and as high as about 350 psi. The source 102 is typically located remotely from the door unit 21 and air lines (e.g., conventional tubing for carrying pressurized air) extends from the source to the remainder of the circuit 100 at the door. Note that use of a hydraulic circuit, the system described in co-pending Pat. App. Serial No. 10/037,514, filed January 4, 2002 which is incorporated herein by reference, or more than one source of air or other power source is contemplated within the scope of the invention.

[0030] The filter 104 is in fluid communication with the air source 102 and is adapted for filtering the air to inhibit passage of particles and condensate that may interfere with downstream components in the circuit, such as the regulator 110, the valve 114 and the cylinders 56, 78. Air flows through the filter and then a portion of the air preferably flows to the checking system 107 which is preferably of one or more of the types described in our co-pending U.S. Patent Application entitled "Pneumatically-Powered Mine Door Installation With Hydraulic Checking System," filed simultaneously and incorporated herein by reference. The system 107 includes, for example, hydraulic cylinders 117 (Fig. 2, omitted for clarity from Figs. 4, 5, and 8) for controlling leaf speed, e.g., to prevent runaway of the door in case of an obstruction blocking the door, and for controlling the sequence

in which the leafs 32, 34 close. A check valve 140 is preferably included upstream of the checking system to prevent back flow of air and back flow of oil from the reservoir 106. The pressure relief valve 108 is disposed downstream from the oil reservoir 106 and is operable to relieve air pressure if pressure in the circuit 100 exceeds normal operating pressure. The remainder of the air flows through the air pressure regulator 110, which is adapted to maintain a substantially constant rate of air flow therethrough so that air pressure at the valve is substantially constant. The air line oiler 112 is preferably disposed between the regulator and the valve for lubricating the valve 114 and the cylinders 56, 78.

[0031] The valve 114 of this embodiment is a 4-way, 3-position solenoid activated spring return spool valve. The valve 114 includes a single air supply inlet port 118, first and second outlet ports 120, 121, and two vent ports 125. The first outlet port 120 of the valve 114 is connected via parallel lines to the closed ends 56a, 78a of the cylinders 56, 78, and the second outlet port 121 of the valve is connected via parallel lines with rod ends 56b, 78b of the cylinders. The vent ports 125 vent air to the atmosphere. A spool of the valve 114 is movable from a center position in which flow through the valve is blocked, to first and second positions for moving the cylinder rods. In the first position, air is directed from the inlet port 118 through the first outlet port 120 to the closed ends 56a, 78a of the cylinders to extend the piston rods 57, 80 of the respective cylinders 56, 78, and simultaneously, rod ends 56b, 78b of the cylinders are vented through one of the vent ports 125 to prevent air pressure from building up therein. Conversely, in the second position, air is directed from the inlet port 118 through the second outlet port 121 to the rod ends 56b, 78b of the cylinders 56, 78 to retract the piston rods 57, 80, and the closed ends 56a, 78a of the cylinders are vented through the other vent port 125.

In this embodiment, all four cylinders 56, 78 are plumbed in parallel, but non-parallel configurations are within the scope of the invention. The valve 114 is preferably also manually operable, and a suitable spool valve is Model No. JK19460 available from Jack Kennedy Metal Products & Buildings, Inc., Taylorville, IL 62568.

[0032] In operation, the valve 114 is activated by a signal from an electrical switch (not shown; suitable switches 184A-D are described in Pat. No. 6,425,820, incorporated herein by reference) which causes the spool to move to the first position and thereby extend the piston rods 57, 80. Due to the parallel lines, there is substantially equal air pressure against the pistons of the cylinders 56, 78. However, the piston rods 80 of the relief door cylinders 78 will extend prior to the piston rods 57 of the leaf cylinders 56 when there is significant air pressure against the doors. This phenomena is due to the fact that the ratio of the piston area of the relief door cylinder to the relief door area is much less than the ratio of the piston area of the leaf cylinder to the leaf area, as is further described in the example below. The checking system controls closing of the leafs to ensure that the right-hand leaf 34 closes before the left-hand leaf 32 so that the astragal 45 on the left-hand leaf covers the gap between the leafs. Thus, the power mechanism described above is constructed to apply driving force to the relief doors 64 and to the leafs 32, 34 for opening and closing the relief doors and the leafs. Moreover, the parallel lines to the relief door and leaf cylinders cause the relief door and the leaf to open in sequence.

[0033] Referring to Fig. 7, the power mechanism may alternatively include a pneumatically controlled pneumatic circuit, generally designated 130, for the cylinders. The circuit of this embodiment includes a pneumatically activated spool valve 114' (in place of the solenoid activated valve 114)

and four pneumatically controlled operation valves 132-135 for operating the spool. This circuit may be mounted in "return air" of the mine because it does not require electrical power and thus there is no risk of a spark from the circuit. The circuit 130 includes a check valve 140 upstream of the checking system to prevent back flow of air.

[0034] The invention allows much less force or power to be used to open the door leafs. As an example, if each leaf face defines an area of 36 square feet and each leaf cylinder has a piston diameter of about 6 inches, the ratio of the leaf area to the piston area is 183:1 Further, if each relief door face defines an area of 1 foot square, and each relief door cylinder has a piston diameter of about 2 inches, then the ratio of the relief door area to the piston area is 46:1. Thus, in this simplified example in which all other variables are assumed to be equal, each relief door will be able to open against almost 4 times more air pressure than the leafs. When the relief door 64 opens, air pressure against the leafs 32, 34 is greatly reduced, e.g., by about at least about one-third, more preferably by at least about one-half, and the leaf cylinders should then be able to open the leafs. Accordingly, the leaf cylinders can be sized smaller than would otherwise be necessary to open the leafs. As will be understood by those of skill in the art, in designing the relief door and power mechanism for the relief door, the relief cylinder 78 is sized to open the relief door in the presence of a maximum expected pressure differential, e.g. about twenty (20) IWG. Also, the area of the relief opening 62 must be large enough to relieve sufficient air pressure against the leaf 32, 34 and thereby allow the leaf cylinders 56 to open the leafs.

[0035] Fig. 8 illustrates a mine stopping system of the present invention which includes two stoppings 20 of the type described above. The stoppings are positioned in the passageway P in spaced apart relation to form an airlock with

an airlock space therebetween. As viewed in Fig. 8, the high pressure side 48 should be to the left of the left-hand stopping 20. In this particular embodiment, both stoppings 20 include relief openings 62 and relief doors 64 as described above, but it is contemplated that one of the stoppings 20 not include a relief opening. The door units 21 may be controlled by a system similar to that described in Pat. No. 6,425,820 (which is incorporated herein by reference) including an interlock for preventing both doors being opened simultaneously.

[0036] As illustrated in the embodiment of Figs. 1-5, the relief openings 62 and relief doors 64 are preferably disposed in positions that are convenient for running power lines (e.g., pneumatic lines) and that do not obstruct personnel and machinery passing through the doorway. The relief opening and relief door are preferably not located on the man door 40 because such location is likely to obstruct personnel passing therethrough. However, the relief opening(s) and door(s) may be disposed anywhere on the stopping, door unit (including in the man door) and frame (or on any combination thereof) within the scope of this invention. To illustrate the point, the stopping 20' of an alternative embodiment shown in Fig. 9, includes a relief opening 162 in one of the stopping panels (generally, the stopping wall) and a power-operated relief door 164 substantially identical to the relief openings and doors described above.

[0037] The relief door 64 may be constructed in many other ways within the scope of this invention. For example, the relief door may include multiple panels, may be any shape and instead of being mounted on hinges, the relief door may be mounted to slide between its open and closed positions, e.g., mounted in tracks (not shown). Further, the relief door need not necessarily be power-operated.

[0038] Fig. 10 shows another embodiment wherein a door unit generally designated 170 comprises a single leaf 172 and a relief opening 174 therein. A relief door 176, constructed similar to the relief doors described above, covers the relief opening 174. Door frame 178 mounts the single leaf 172 and, in this embodiment, directly engages the ribs R,L, ceiling C and floor F of the passageway P such that no stopping panels are required to seal the passageway. As discussed above, the relief opening 174 is preferably disposed in the single leaf 172 but may also be disposed on the man door.

[0039] In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

[0040] When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles "a", "an", "the" and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including" and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0041] As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.